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ABSTRACT

The value of the credit hour as a measure of performance of students, faculty, and organizations in higher education was examined. Testing the hypothesis that work time effort and designated repertoire are equal for a given credit across all students, student work time was examined in an individualized instructional system. Large differences were found in the time required by 500 different students. Implications of the data for higher education are discussed and a proposal made for redefining the credit hour from an input measure to one of output. (Author/PF)

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THE CREDIT HOUR: AN ANACHRONISM

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ABSTRACT

The Credit Hour: An Anachronism

The credit hour is the measure of performance of students, faculty, and organizations in higher education. It posits that work time effort and designated repertoire are equal for a given credit across all students. This study examines student work time to achieve a common criterion level in an individualized, instructional system. The large time differences that are found document what had been previously "known" but ignored. What is implied in these data for higher education in its use of the credit hour is discussed with special emphasis to redefining the credit hour from an input measure to one of output.

The Credit Hour: An Anachronism*

Ernest A. Vargas

The credit hour is the unit of measure in academia. The student, the faculty member, and the department are all assessed by it. For the student, it is presumably an index of how much he has learned. He is graduated, credentialed as an expert in some area after he has had so many credit hours in it. The faculty member is putatively teaching the student, and how much he is teaching is designated by the number of credit course hours in his "load". The department's productivity is the sum of its faculty credit hours multiplied by the number of students carrying them. A heavy portion of the department's budget is decided by this index.

Two assumptions underlie the use of the credit hour: one, that each credit hour represents an equal amount of work time from all students, and two, that repertoire or skills are equivalent within any given grade range. The second assumption will not be discussed except in passing. In norm-referenced testing, which is the prevalent grading measure used in the university, credit hour attained means radically different things for different students with respect to what and how much is known. The meaning of the credit-hour grade differs with different professors, different reference groups of students, and even with different testing

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situations. It is no surprise that there is little or no correlation between undergraduate grades and later occupational success (1). Only with criterion-referenced testing in a teaching mode where there are explicit behavioral objectives will some common meaning begin to accrue to the credit hour grade.

The other main assumption underlying credit hours is that they imply equal amounts of work, and therefore equal achievements. The credit hour is thus used to designate how much work (the number of courses), a student will do, or will be allowed to do, within a certain time frame such as a semester or a quarter. The student thereafter is said to have achieved a certain amount of knowledge in a given subject matter within that time. Extra credits are given for better grades, an A is sometimes said to be worth three times the base of C, so for the presumed equivalent time spent, a student is said to have achieved so much more or less than his fellow students. Even with criterion-referenced testing, the credit hour implies that all students put in the same effort. If criterion mastery is uniform, achievement is seen as equivalent. It is, of course, equivalent if the amount of work has been equal. This paper empirically examines this second assumption.

PROCEDURE:

Three credit hours are given for a large (500 students) undergraduate course in educational psychology. There are ten modules in the course. Each module except the last has a pre-and post-test and a set of instructional activities. (The last module at the time of the study was a set-time multi-image presentation and is not included in the analysis of the data.) The student must pass the pre- or post-test of a module at a satisfactory level, 90 per cent, before going on to the next module.

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The student has to recycle through the pertinent material as many times as necessary until he reaches the 90 per cent criterion level. He is told on which behavioral objectives he made his errors and concentrates on material pertinent to those. Most modules must be finished in a week; some require two.

Except for section meetings, all tests are taken and materials studied in a learning center. The instruction varies in mode and format, and texts, slidetapes, programmed instruction, and tutoring are used. The tests are taken in a special area in the Center. Each test is a unique selection of randomly selected items from a large set of items arranged in subsets according to behavioral objective. The section meetings are "labs" where material previously learned is applied in special projects.

In the Learning Center the students check out and return all material and tests over a counter. Time clocks record the time when material and tests are checked out and in. All transactions are recorded on Module Activity Cards. The type of material,

--------Figure 1A and 1B about here--------

the particular form of the test, and the Julian date is noted by the counter clerk on the card. Tutoring time is recorded by instructors.

There is one Module Activity Card per student for each unit of module, ten in all for each student. Module Activity Cards are managed in such a way as to keep an up-to-date record on the student. The information on these cards is eventually coded and key punched. A computer program processes the data for management purposes. Special-purpose programs are written for studies such as this one.

A sample of 156 students was used for this study. The number varies slightly from module to module as some students pretested out of some

instructional components. There was no attempt to systematically select the students. The sample was sufficiently large to represent the range of times involved.

RESULTS:

The length of time for each test and instructional activity for each student was obtained. The results are presented in the following two tables. One table displays the results per module and the other per student.

--------Table 1 about here--------

As can be noted, total average times, which include both instruction and test time, vary substantially between modules. The shortest total mean time is that of module eight with 104 minutes (1.7 hours) and the longest is module nine with 269 minutes (4.5 hours). The mean instruction time varied from 81 minutes (1.4 hours) in module eight to 175 minutes (almost 3 hours) in module nine. The variation in total and instruction mean time is as much due to difference in amount and type of instruction as to student differences. Some modules were not only more difficult but also may have had more material, for example a slide-tape presentation as well as documents covering the same concepts. This variation in load is familiar to students who not only encounter it within courses but experience its concentrated effect between courses. The metaphor "swamped" exactly describes peaks in this oscillating effect. Only by obtaining the time taken for any module or course of study can we begin to even out these effects.

The mean times in testing also vary from module to module, from a low average of 44 minutes to a high of 95 minutes. The variation is largely due to the number of retests (though data not presented show large

differences between students in time per test). An interesting aspect of the test time is its proportion of the total time taken with the module. In general it averaged a little under a third (27 per cent). How much test time it should take to pass a module of instruction and its proper ratio to instruction time should be explicitly studied, but two points should be made about these data. First, except for those students who passed the pretest, all students had at least two tests for any module, i.e. the pre and the post. Second, a portion of the students had trouble passing the post test at the 90 per cent criterion level. They recycled and retested quite often, in some cases with the required, but possibly merely a perfunctory, look at the material. This was an attempt to beat the tests. It proved to be unfeasible because tests were frequently scrambled with new items drawn at random from large item pools. Despite the caveats, these data <u>may</u> imply that students in the typical course with a much smaller percentage of time spent in testing, may study too much and hence be wasting their time. Having a pretest denoting how much they know, together with behavioral objectives with attached error frequencies pointing to what they should concentrate on, allows them to judge how much and what sort of effort they should make. The usual course does not have this, and furthermore, has poorly designed tests for which the student compensates by "over-studying" or by learning irrelevant details. There is much efficiency to be gained by having the student study only what is appropriate.

The range of times needed to reach the common standard of 90 per cent was quite extensive within modules. This can be seen by noting the differences between the student with the lowest total time and the student with the highest total in any module. For example, in module two the range goes from a low of 13 minutes to a high of 849 minutes (14.2 hours).

Different students are involved here. One pre-tested out of the module and the other may have had to recycle repeatedly. But having a notion of the outside limits is important for future design and the remaking of a module, especially in fitting it with others in a course. The range of time of only testing or instruction within a module is also quite great. As can be seen in Table I, the times of the fastest and slowest**students differ by almost a factor of 20 in testing and up to a factor of 80 in instruction.

Table II gives the times taken by the top and bottom ten students of the sample of 156. There were no sharp discontinuities in the sample.

--------Table II about here--------

The shortest total test time taken to complete nine modules by any student was 205 minutes (3.4 hours), and the longest test time was 1379 minutes (23 hours). With respect to total instruction time over the ten modules, the shortest was 376 minutes (6.3 hours) and the longest 2659 minutes (42.7 hours). Total time (including both instruction and testing) ranged from a low of 778 minutes (13 hours) to a high of 3958 minutes (66 hours). Thus, there is a difference of over four times as much time between the lowest and highest student in reaching the same criterion level, and getting the same grade and the same credit hours. The point is exemplified further by comparing the top quintile with the bottom quintile of the sample. The mean difference between the two groups is a little over 2500 minutes; a substantial difference of over 42 hours for one course.

**These terms, unfortunately, also have moral and quality overtones not implied here.

The course credit hours clearly do not indicate the number of hours actually expended.

The results assert a simple fact, one that teachers have always "known".*** Different students take different amounts of time to achieve a common criterion. What has been implied in this well known but previously "undocumented" fact has been ignored and any problems which have resulted have been thrown on the student. If too much work is given to the student, he is given a low grade; if not enough, it is he who remains ignorant. New instructional technologies could facilitate solutions. However, further refinements in these new instructional arrangements such as obtaining baseline and time data, are needed as standard operating procedures.

DISCUSSION:

I. As more instructional systems begin to be developed within the operant framework, prior formulations of achievement and effort will be out of joint with the theoretical basis of these systems and of how they operate. Institutions change slowly, if at all, and progress requires that what is implied organizationally in new procedures be made clear. The new instructional arrangements call for changes in much of what is done or taken for granted in higher education.

The credit hour denotes nothing more than length of exposure to an educational environment. But it is the linch-pin of accountability for the student, the teacher, and the organization. Current attempts at

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***These sorts of findings are common in the programmed instruction literature. A number of programmed books will give the range and average time for different types of students who take the program.

instructional accountability are in a morass, and a dead end one at that, because the wrong unit of measure is being used. The traditional formulation does not reveal what effects are occurring from teaching. It may even hide such effects. There are two immediate results: since it is not known what is occurring, it is difficult to choose rationally among alternative teaching procedures, and since reward structures are built on evaluation schemes, a number of inequities occur with students, faculty, and educational organizations.

Students: The present meaning of the credit hour fails to consider student differences and even obscures them. It is not equitable to give the same hours of credit to students who vastly differ in the amount of time taken to achieve a common criterion level. Considerations of social and academic background are neglected. In addition, the prime characteristic that tends to pay-off is a fast rate of learning. Other repertoires, or their development, are usually ignored. This is harmful both to the student who learns fast and to the student who learns more slowly. The fast student is later not prepared for the many situations where learning fast is not the most useful skill. The slower student may have other repertoires, which may have little opportunity to be demonstrated, such as tenaciously working through eventually, to an imaginative solution of a problem. Furthermore, individualization of instruction can not get very far unless student differences can have an effect on the organizational setting in which instruction takes place. For example, the student who goes through a course quickly is forced to wait until the next semester begins before he can start a new one. Time is unnecessarily lost. The student who needs more time with a course is also shortchanged. His work must be squeezed

into the institutional time frame for the "average" student. This difficulty is compounded by those professors who confuse huge assignments with effective teaching.

Faculty: As long as the credit hour is input defined, little progress will be made in knowing how well faculty are teaching. Are faculty innovative or engaged in routine teaching? Are they changing students more or less, or having no effect? Even more important, are reward arrangements encouraging extra effort and initiative in teaching? The faculty member who lectures three times a week to a class of 500, racks up 1500 credit hours for himself and his department. The professor who attempts to innovate with the same class, and who therefore must spend more than the usual amount of hours, gets the same credit. Further, regardless of which class produces more behavioral change, both get equal credit. Behavioral change is not denoted by the credit hour. Yet the critical factor in teaching is for the teacher to transform his students, to bring about skills, whether of knowledge or problem solving, they did not previously have. Teacher excellence should be ranked by degree of change produced. Because the credit hour for faculty is not a measure of teaching achievement but of presumed work load, it is disproportionately rewarding for those who stay with the traditional lecture system. The very unit used to define work makes it difficult to assess and reward teaching accomplishment since by its nature it measures mostly student numbers. Ironically, the faculty member who teaches more effectively produces a greater percentage of higher grades but gets accused of washing out standards or using ersatz ones. This leaves us with an assessment procedure for faculty in teaching which usually resolves to testimonials from students and sometimes peers.

Educational Organizations: Since the credit hour gives no inkling of what change was accomplished, institutions of higher education may be ranked inappropriately, and administrators who wish to innovate are presented with special difficulties. Administrators do not drag their heels out of malevalence. They are usually under political and budgetary contingencies which makes them cautious and offer little flexibility. Under these circumstances there are always difficulties with new technologies. New technologies usually require large start-up costs, and are more capital intensive. If the organization's productivity index cannot reflect the effects of greater resource commitment, then further efforts are discoura ed. At the very least additional monies won't be forthcoming and any further ventures have to be made within what is usually budgeted. Legislators and other outside parties question why the large undergraduate course which has always had one professor and a half dozen graduate assistants, now requires a course manager, data processing personnel, and extra monies for new media, and perhaps clerical assistance. At worst, it is deemed another boondoggle: at best, another example of how university and college administrators are not realistic, since the same number of credit hours are produced after the help as before. Other universitites are said to be doing quite nicely without all the fuss about new techniques and the additional resources they require. This prestigious Eastern school and that famous West Coast one are pointed out as still turning out first class students. The comparisons are meaningless without taking into account the entry level of the students, how much they were changed, and what was responsible for the change. Social class and prior schooling may account for much of what may be deemed the results of good teaching at schools where students are an elite or come from one. A proper measure

is needed to draw attention and support to those institutions which are doing more with what they get.

II. The "credit hour" should be response defined and out-put oriented. "It" might still be used as a productivity and achievement index, but as a behavioral unit. It would be a measure defined by what the student is doing, or has done, rather than by that to which he has been exposed. It would thus be a better source of information to the student, the teacher, the institution, and to any outside party.

The benefits, as implied above, would be many. One, for example, would be to stress the distinction between what was achieved from what was involved in achieving it. Criterion referenced testing already emphasizes giving equal credit to those changed enough to meet a prior standard. If differential credit is to be given, it should be done on the basis of rate of change and amount of change. Norm referenced measures could be used here to reward for persistence and discipline, but also reward that individual who for some curious reason has a quicker grasp of some particular discipline. Recognizing both rates and degrees of change and levels of knowledge, would facilitate counseling the student. For example, students could be provided with projection curves showing how much time it takes someone with a given pretest score to achieve mastery in a particular course. The student and his advisor could adjust the work load accordingly. Further, forcing examination of what behaviors are credited and how they are credited, may lead to producing behaviors not simply related to the knowledge domain. If creativity, problem solving skills, and so forth are not being learned, it may be because these behaviors are not measured and no credit is given when they are produced.

New procedures and new formulations would be needed. Instructional arrangements must obtain baseline measures on what is to be taught and also obtain a detailed time record of all student efforts. New formulas would be used describing behavioral change over time or some other factor; for example, for organizational purposes, cost could be used in the denominator. The student's report slip would no longer look as it does now with course, credit hour, and grade. It would be a much more detailed description of achievement, with rates and degrees of change in different subject areas.

The above were suggestions, but the objective is a necessity - to dispense with the credit hour as now used. This calls for a great many changes in how educational organizations presently organize and assess instruction. Instructional systems which derive from a new and better understanding of the individual imply that the student's behavior and its change is important. Institutional assessment procedures should reflect this fact.

References

1. Milton, O. Alternatives to the Traditional, chapter 3, Jossey-Bass, Inc., San Francisco, 1972.

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Table 1

Time Per Module
(In minutes)

Unit	Instructional Component	N	Mean	Standard Deviation	Ranges* Low	High
1	Test	156	53	34	11	205
	Instr.	151	128	61	50	369
	Total	156	177	92	11	574
2	Test	156	71	40	13	263
	Instr.	152	171	92	32	586
	Total	156	238	128	13	849
3	Test	156	63	46	12	364
	Instr.	136	129	69	26	351
	Total	156	177	112	12	538
4	Test	156	45	27	10	184
	Instr.	146	101	68	3	330
	Total	156	140	87	13	442
5	Test	156	64	37	8	193
	Instr.	142	164	74	66	449
	Total	156	213	112	8	642
6	Test	156	65	38	12	224
	Instr.	144	122	63	36	407
	Total	156	177	95	12	493
7	Test	155	51	35	10	174
	Instr.	125	97	42	23	282
	Total	155	129	79	10	351
8	Test	156	44	32	7	186
	Instr.	125	97	42	23	282
	Total	156	104	74	7	372
9	Test	156	95	46	12	682
	Instr.	155	175	96	20	591
	Total	156	269	126	12	682
10	Test	0				
	Instr.	156	40	0	40	40
	Total	156	40	0	40	40

*Pretest times were usually the lowest times of the range. Even though no instruction takes place, test time is the lower limit of the instructing time of a module since it costs both the student and the instructional system. (It could be argued that a student learns something from any test.) The instructional costs for students and colleges for students to go through material already known must be quite high.

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Table 2

Time Per Student

(In minutes)

Module	1	2	3	4	5	6	7	8	9	10	Total
Student Position						Test Times					
1	36	24	13	22	8	26	13	10	43	0	205
2	27	22	33	11	62	43	15	12	30	0	255
3	26	20	12	21	31	67	27	11	41	0	256
4	23	63	40	19	31	13	14	12	52	0	267
5	22	30	12	35	43	12	13	11	97	0	275
6	21	18	38	19	28	29	15	34	80	0	282
7	23	17	23	27	29	42	11	39	73	0	284
8	36	46	13	26	31	12	12	19	90	0	285
9	38	28	12	24	17	30	72	14	60	0	295
10	26	27	15	24	26	46	25	39	75	0	303
147	66	117	162	30	189	127	54	67	96	0	908
148	55	121	127	84	193	97	50	29	165	0	921
149	160	124	144	72	95	76	90	77	93	0	931
150	172	88	52	57	168	71	47	68	209	0	932
151	152	64	90	49	43	144	47	85	286	0	960
152	168	74	76	51	181	97	119	130	168	0	1064
153	77	133	47	99	90	162	174	51	244	0	1077
154	113	233	178	45	99	189	128	141	173	0	1299
155	159	165	219	63	135	132	145	186	110	0	1314
156	205	263	143	184	129	224	95	60	76	0	1379
						Instruction Times					
1	50	68	0	0	0	71	35	25	87	40	376
2	67	127	51	48	76	0	0	26	54	40	489
3	57	82	74	45	113	0	0	0	100	40	511
4	68	47	73	18	0	90	44	35	99	40	514
5	69	142	0	22	0	45	88	0	115	40	521
6	60	32	94	111	0	100	24	0	79	40	540
7	57	71	0	83	151	0	0	0	162	40	564
8	87	53	79	9	92	36	0	61	142	40	599
9	64	44	62	33	74	64	60	82	78	40	601
10	0	75	0	25	92	103	40	43	193	40	611
147	222	188	343	149	252	329	104	0	175	40	1802
148	242	188	119	152	113	145	122	96	591	40	1808
149	183	257	157	105	395	188	183	69	264	40	1841
150	310	193	305	307	269	104	116	58	141	40	1843
151	129	221	351	194	143	318	76	105	309	40	1886
152	136	328	185	330	322	319	114	102	354	40	2230
153	163	267	161	235	386	323	282	160	468	40	2485
154	369	586	255	258	383	269	121	60	185	40	2526
155	215	429	290	178	449	254	158	88	459	40	2560
156	275	530	351	220	239	169	194	228	413	40	2659

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Table 2

(Continued)

Module:	1	2	3	4	5	6	7	8	9	10	Total
Student Position	Total Times										
1	80	145	114	64	144	13	14	12	152	40	778
2	73	106	16	20	22	126	81	67	243	40	794
3	79	101	12	118	194	12	13	11	259	40	839
4	84	59	146	152	16	133	51	15	156	40	852
5	108	71	117	28	120	65	15	95	222	40	881
6	95	64	97	37	16	148	65	61	261	40	884
7	99	222	82	91	113	29	24	55	141	40	896
8	107	226	16	46	19	111	157	15	175	40	912
9	112	67	94	58	98	94	107	131	117	40	918
10	156	184	13	155	8	95	13	10	272	40	946
147	176	299	442	226	198	425	106	209	422	40	2543
148	373	295	146	216	425	255	153	218	454	40	2575
149	420	287	417	360	351	183	212	92	222	40	2584
150	350	481	438	135	308	193	198	302	237	40	2682
151	509	395	325	249	409	200	180	170	239	40	2716
152	180	399	271	379	398	380	154	136	486	40	2823
153	223	336	311	295	511	442	351	207	596	40	3312
154	270	550	417	262	642	351	208	117	624	40	2481
155	574	849	398	442	512	493	216	120	261	40	3905

STUDENT NAME

NUMBER

MODULE 1
TEACHING AS CHANGING BEHAVIOR

Figure 1A

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G.I. _____ SEMESTER _____ YEAR ___

CODE	SCORE	ACTIVITY	COPY	DATE	ENTRY	TIME
1.0101		PRETEST			OUT	
					IN	
2.0101		TEXT–CHAPTER 1			OUT	
					IN	
2.0101		TEXT–CHAPTER 1			OUT	
					IN	
2.0102		TEXT–CHAPTER 2			OUT	
					IN	
2.0102		TEXT–CHAPTER 2			OUT	
					IN	
2.0103		TEXT–CHAPTER 3			OUT	
					IN	
2.0103		TEXT–CHAPTER 3			OUT	
					IN	
1.0102		POSTTEST 1			OUT	
					IN	
					OUT	
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